



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/509,370	09/28/2004	Takuya Sugawara	101249.55459US	3987
23911 7590 12/28/2006 CROWELL & MORING LLP INTELLECTUAL PROPERTY GROUP P.O. BOX 14300 WASHINGTON, DC 20044-4300			EXAMINER DEO, DUY VU NGUYEN	
			ART UNIT	PAPER NUMBER
			1765	
SHORTENED STATUTORY PERIOD OF RESPONSE		MAIL DATE	DELIVERY MODE	
3 MONTHS		12/28/2006	PAPER	

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary

Application No.

10/509,370

Applicant(s)

SUGAWARA ET AL.

Examiner

Duy-Vu N. Deo

Art Unit

1765

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 03 October 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 16-65, 71 and 72 is/are pending in the application.
- 4a) Of the above claim(s) 66-70 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 16-65, 71, 72 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

3. Claims 16-22, 25-31, 54-55, 64-65, and 71-72 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ohmi (U.S. Patent Appl. Pub. No. 2002/0014666) ("Ohmi I"), in view of Wolf et al., *Silicon Processing for the VLSI Era*, Vol. 1, Lattice Press (1986) ("Wolf I"), in further view of Mintz et al. (U.S. Patent No. 5,618,282).

4. As to claim 16, Ohmi I discloses a process for forming an insulating film on the surface of a substrate for electronic device, comprising: a second step of oxidizing the substrate (11) with plasma based on a second process gas comprising at least a rare

Art Unit: 1765

gas and oxygen (paragraphs 0090-0091), to thereby form an oxide film thereon (12A) (paragraph 0095; Figure 10A-10B).

5. Ohmi I does not expressly disclose a first step of cleaning the substrate with plasma based on a first process gas comprising at least a rare gas. Wolf I teaches that scrupulously clean wafers are critical for obtaining high yields for semiconductor fabrication (page 514). Mintz teaches a cleaning step comprising treatment based on plasma based (column 1, lines 15-18) on a process gas comprising at least a rare gas (column 6, lines 15-23). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to include a step of cleaning, and the cleaning step comprises treatment based on plasma based on a process gas comprising at least a rare gas. One who is skilled in the art would be motivated to obtain a high yield and to adopt a method known to accomplish the task of wafer cleaning.

6. Mintz teaches that the first step is performed using plasma processing (column 6, lines 15-25). Ohmi I teaches that the second step is performed using plasma processing (paragraphs 0088-0091). Thus, the first and second steps are conducted under the same operation principle (plasma processing).

7. As to claim 17, Mintz discloses that the first process gas comprises hydrogen gas (column 6, lines 21-23).

8. As to claim 18, Mintz does not expressly disclose that the first step is conducted at a pressure of 7-133 Pa. However, Mintz discloses a pressure of 5.33 Pa (40 mTorr) (column 6, lines 15-16). It should be noted that this pressure range is similar to

Art Unit: 1765

Applicants' pressure. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a pressure of 7-133 Pa. One who is skilled in the art would be motivated to use a pressure similar to 5.33 Pa, which is known to be effective for wafer cleaning.

9. As to claim 19, Mintz teaches that the first step is performed using plasma processing (column 6, lines 15-25). Ohmi I teaches that the second step is performed using plasma processing (paragraphs 0088-0091). Thus, the first and second steps are conducted under the same operation principle (plasma processing).

10. As to claim 20, Ohmi I discloses a third step to be conducted after the second step, of nitriding the oxide film with plasma based on a third process gas comprising at least a rare gas and nitrogen (paragraph 0092).

11. As to claim 21, Ohmi I does not expressly disclose a fourth step to be conducted after the third step, of treating the oxide film with plasma based on a fourth process gas comprising hydrogen gas. However, Ohmi I discloses that the nitride layer formed in the third step may be formed with a mixed gas of nitrogen and hydrogen to reduce the trapping of electrons or holes in the film (paragraphs 0077, 0092). Moreover, case law has held that the transposition of two steps or the splitting of one step into two steps, where the processes are substantially identical or equivalent in terms of function, manner and result, does not patentably distinguish the processes. *Ex parte Rubin*, 128 USPQ 440 (Bd. App. 1959); MPEP § 2144.04 (IV)(C). Ohmi I simultaneously forms and treats the silicon nitride film with nitrogen and hydrogen (paragraphs 0077, 0092).

Thus, Applicants' fourth step to be conducted after the third step, of treating the oxide

Art Unit: 1765

film with plasma based on a fourth process gas comprising hydrogen gas is the splitting of one step into two steps, where the processes are substantially identical or equivalent in terms of function, manner and result. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to include a fourth step to be conducted after the third step, of treating the oxide film with plasma based on a fourth process gas comprising hydrogen gas.

12. As to claim 22, Ohmi I does not expressly disclose a fifth step to be conducted after the second step, of treating the oxide film with plasma based on a fourth process gas comprising hydrogen gas. However, Ohmi I discloses that the nitride layer formed after the second step may be formed with a mixed gas of nitrogen and hydrogen to reduce the trapping of electrons or holes in the film (paragraphs 0077, 0092).

Moreover, case law has held that the transposition of two steps or the splitting of one step into two steps, where the processes are substantially identical or equivalent in terms of function, manner and result, does not patentably distinguish the processes. *Ex parte Rubin*, 128 USPQ 440 (Bd. App. 1959); MPEP § 2144.04 (IV)(C). Ohmi I simultaneously forms and treats the silicon nitride film with nitrogen and hydrogen (paragraphs 0077, 0092). Thus, Applicants' fifth step to be conducted after the second step, of treating the oxide film with plasma based on a fourth process gas comprising hydrogen gas is the splitting of one step into two steps, where the processes are substantially identical or equivalent in terms of function, manner and result. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention

Art Unit: 1765

was made to include a fifth step to be conducted after the second step, of treating the oxide film with plasma based on a fourth process gas comprising hydrogen gas.

13. As to claim 25, Ohmi I discloses a process for forming an insulating film on the surface of a substrate for electronic device, comprising: a second step of nitriding the substrate (11) with plasma based on a second process gas comprising at least a rare gas and nitrogen (paragraphs 0090-0091), to thereby form a nitride film thereon (12B) (paragraph 0095; Figure 10A-10B).

14. Ohmi I does not expressly disclose a first step of cleaning the substrate with plasma based on a first process gas comprising at least a rare gas. Wolf I teaches that scrupulously clean wafers are critical for obtaining high yields for semiconductor fabrication (page 514). Mintz teaches a cleaning step comprising treatment based on plasma based (column 1, lines 15-18) on a process gas comprising at least a rare gas (column 6, lines 15-23). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to include a step of cleaning, and the cleaning step comprises treatment based on plasma based on a process gas comprising at least a rare gas. One who is skilled in the art would be motivated to obtain a high yield and to adopt a method known to accomplish the task of wafer cleaning.

15. Mintz teaches that the first step is performed using plasma processing (column 6, lines 15-25). Ohmi I teaches that the second step is performed using plasma processing (paragraphs 0088-0091). Thus, the first and second steps are conducted under the same operation principle (plasma processing).

Art Unit: 1765

16. As to claim 26, Mintz discloses that the first process gas comprises hydrogen gas (column 6, lines 21-23).

17. As to claim 27, Mintz does not expressly disclose that the first step is conducted at a pressure of 7-133 Pa. However, Mintz discloses a pressure of 5.33 Pa (40 mTorr) (column 6, lines 15-16). It should be noted that this pressure range is similar to Applicants' pressure. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a pressure of 7-133 Pa. One who is skilled in the art would be motivated to use a pressure similar to 5.33 Pa, which is known to be effective for wafer cleaning.

18. As to claim 28, Mintz teaches that the first step is performed using plasma processing (column 6, lines 15-25). Ohmi I teaches that the second step is performed using plasma processing (paragraphs 0088-0091). Thus, the first and second steps are conducted under the same operation principle (plasma processing).

19. As to claim 29, Ohmi I does not expressly disclose comprises a third step to be conducted after the second step, of oxidizing the nitride film with plasma based on a third process gas comprising at least a rare gas and oxygen. However, Ohmi I discloses that a stacked nitride/oxide/nitride structure in place of oxide film (12A) and nitride film (12B). Ohmi I further discloses oxidizing the silicon with plasma based on a third process gas comprising at least a rare gas and oxygen (paragraph 0029). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to include a third step to be conducted after the second step, of oxidizing the nitride film with plasma based on a third process gas comprising at least a

Art Unit: 1765

rare gas and oxygen, because there is a suggestion of forming a stacked nitride/oxide/nitride structure in place of oxide film (12A) and nitride film (12B).

20. As to claim 30, Ohmi I does not expressly disclose a fourth step to be conducted after the third step, of treating the oxide film with plasma based on a fourth process gas comprising hydrogen gas. However, Ohmi I discloses that the nitride layer formed in the third step may be formed with a mixed gas of nitrogen and hydrogen to reduce the trapping of electrons or holes in the film (paragraphs 0077, 0092). Moreover, case law has held that the transposition of two steps or the splitting of one step into two steps, where the processes are substantially identical or equivalent in terms of function, manner and result, does not patentably distinguish the processes. *Ex parte Rubin*, 128 USPQ 440 (Bd. App. 1959); MPEP § 2144.04 (IV)(C). Ohmi I simultaneously forms and treats the silicon nitride film with nitrogen and hydrogen (paragraphs 0077, 0092).

Thus, Applicants' fourth step to be conducted after the third step, of treating the oxide film with plasma based on a fourth process gas comprising hydrogen gas is the splitting of one step into two steps, where the processes are substantially identical or equivalent in terms of function, manner and result. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to include a fourth step to be conducted after the third step, of treating the oxide film with plasma based on a fourth process gas comprising hydrogen gas.

21. As to claim 31, Ohmi I does not expressly disclose a fifth step to be conducted after the second step, of treating the oxide film with plasma based on a fourth process gas comprising hydrogen gas. However, Ohmi I discloses that the nitride layer formed

Art Unit: 1765

after the second step may be formed with a mixed gas of nitrogen and hydrogen to reduce the trapping of electrons or holes in the film (paragraphs 0077, 0092).

Moreover, case law has held that the transposition of two steps or the splitting of one step into two steps, where the processes are substantially identical or equivalent in terms of function, manner and result, does not patentably distinguish the processes. *Ex parte Rubin*, 128 USPQ 440 (Bd. App. 1959); MPEP § 2144.04 (IV)(C). Ohmi I simultaneously forms and treats the silicon nitride film with nitrogen and hydrogen (paragraphs 0077, 0092). Thus, Applicants' fifth step to be conducted after the second step, of treating the oxide film with plasma based on a fourth process gas comprising hydrogen gas is the splitting of one step into two steps, where the processes are substantially identical or equivalent in terms of function, manner and result. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to include a fifth step to be conducted after the second step, of treating the oxide film with plasma based on a fourth process gas comprising hydrogen gas.

22. As to claim 54 and 55, Ohmi I discloses that the plasma is generated using microwave irradiation (paragraph 0042).

23. As to claim 64 and 65, Ohmi I discloses that the insulating film is a gate insulator (paragraph 0088).

24. As to claims 71 and 72, Ohmi I does not expressly disclose that the substrate is subjected to wet cleaning prior to the plasma cleaning in the first embodiment. Wolf I teaches that scrupulously clean wafers are critical for obtaining high yields for semiconductor fabrication (page 514). In the second embodiment, Ohmi I discloses that

Art Unit: 1765

the substrate is subjected to wet cleaning ("RCA cleaning process," paragraphs 0105). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to subject the substrate to wet cleaning prior to the plasma cleaning. One who is skilled in the art would be motivated to obtain a high yield and to adopt a method known to accomplish the task of wafer cleaning.

Claim Rejections - 35 USC § 103

25. Claims 23, 24, 32, 33, and 56-59 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ohmi, in view of Wolf I, in further view of Mintz, in further view of Wolf, *Silicon Processing for the VLSI Era*, Vol. 4, Lattice Press (2002) ("Wolf IV").

26. As to claim 23, Ohmi I does not expressly disclose a step to be conducted after the fourth step, of forming a High-k film. Ohmi I discloses that additional layers may be formed after oxide film (12A) and nitride film (12B) (paragraph 0100). Thus, there is a suggestion of forming an additional dielectric layer over (12A/12B) (paragraph 0100). Wolf IV further teaches a need for high-k dielectrics ($k > 7$) in metal-oxide-semiconductor field effect transistors, due to the increase in undesirable tunneling effects associated with thinner gate oxides, a result of device miniaturization (page 145). Wolf also teaches that many important high-k materials are currently under investigation as a replacement for silicon oxide as a gate dielectric (pages 145-46). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to include a step to be conducted after the fourth step for forming a High-k film. One who is skilled in the art would be motivated to find a high-k material

Art Unit: 1765

replacement for silicon oxide as a gate dielectric to reduce the undesirable tunneling effects.

27. As to claims 24 and 33, Ohmi I does not expressly disclose a step to be conducted after the fifth step, of forming a High-k film. Ohmi I discloses that additional layers may be formed after oxide film (12A) and nitride film (12B) (paragraph 0100).

Thus, there is a suggestion of forming an additional dielectric layer over (12A/12B).

Wolf IV further teaches a need for high-k dielectrics ($k > 7$) in metal-oxide-semiconductor field effect transistors, due to the increase in undesirable tunneling effects associated with thinner gate oxides, a result of device miniaturization (page 145). Wolf also teaches that many important high-k materials are currently under investigation as a replacement for silicon oxide as a gate dielectric (pages 145-46).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to include a step to be conducted after the fifth step for forming a High-k film. One who is skilled in the art would be motivated to find a high-k material replacement for silicon oxide as a gate dielectric to reduce the undesirable tunneling effects.

28. As to claim 32, Ohmi I does not expressly disclose a step to be conducted after the fourth step, of forming a High-k film. Ohmi I discloses that additional layers may be formed after oxide film (12A) and nitride film (12B) (paragraph 0100). Thus, there is a suggestion of forming an additional dielectric layer over (12A/12B). Wolf IV further teaches a need for high-k dielectrics ($k > 7$) in metal-oxide-semiconductor field effect transistors, due to the increase in undesirable tunneling effects associated with thinner

Art Unit: 1765

gate oxides, a result of device miniaturization (page 145). Wolf also teaches that many important high-k materials are currently under investigation as a replacement for silicon oxide as a gate dielectric (pages 145-46). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to include a step to be conducted after the fourth step for forming a High-k film. One who is skilled in the art would be motivated to find a high-k material replacement for silicon oxide as a gate dielectric to reduce the undesirable tunneling effects.

29. As to claims 56-59, Ohmi I does not expressly disclose the High-k film comprises at least one material selected from the group consisting of Al_2O_3 , ZrO_2 , HfO_2 , Ta_2O_5 , silicates and aluminates. However, Wolf IV teaches that important high-k materials for metal-oxide-semiconductor field effect transistors include Al_2O_3 , ZrO_2 , HfO_2 , and Ta_2O_5 (Table 4-1, page 146). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made use the High-k film comprises at least one material selected from the group consisting of Al_2O_3 , ZrO_2 , HfO_2 , Ta_2O_5 . One who is skilled in the art would be motivated to select a high-k material that is recognized as an important material for metal-oxide-semiconductor field effect transistor applications.

Claim Rejections - 35 USC § 103

30. Claims 34-37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ohmi, in view of Wolf I, in further view of Mintz, in further view of Kern, *Handbook of Semiconductor Wafer Cleaning Technology*, Noyes Publications (1993).

31. As to claims 34-37, Ohmi I does not expressly disclose that a hydrogen plasma pressure is conducted at a pressure of 133 Pa. However, Kern teaches a hydrogen

Art Unit: 1765

plasma cleaning method (page 225), including a hydrogen plasma pressure of 1 Torr (or 133 Pa) (Table 3, page 226). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a hydrogen plasma pressure of 133 Pa, because Kern teaches that this pressure is effective for cleaning wafers.

Claim Rejections - 35 USC § 103

32. Claims 38-41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ohmi, in view of Wolf I, in further view of Mintz, in further view of Kern, in further view of Cohen et al. (U.S. Patent Appl. Pub. No. 2002/0009892).

33. As to claims 38-41, Ohmi I does not expressly disclose that the hydrogen plasma processing is conducted at a rate gas flow rate of 500-2000 sccm, and a hydrogen gas flow rate of 4-500 sccm. Cohen discloses a method for hydrogen plasma cleaning (paragraph 0021), including a hydrogen flow of up to 2000 sccm (paragraph 0033). It should be noted that Cohen's gas flow range overlaps with Applicants' range.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use hydrogen plasma processing conducted at a rate gas flow rate of 500-2000 sccm, and a hydrogen gas flow rate of 4-500 sccm. One who is skilled in the art would be motivated to use a gas flow rate similar to Cohen's gas flow rate, which is known to be effective for wafer cleaning.

Claim Rejections - 35 USC § 103

34. Claims 48-51 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ohmi, in view of Wolf I, in further view of Mintz, in further view of Rossnagel et al., *Handbook of Plasma Processing*, Noyes Publications (1990).

35. As to claims 48 and 49, Ohmi I does not expressly disclose that the plasma has an electron temperature of 0.5-2 eV. However, Rossnagel teaches that a typical electron temperature for a plasma etch (or clean) is 3 to 30 eV (Table 1, page 198). It should be noted that Applicants' electron temperature range is similar to Rossnagel's temperature range. Therefore, because Applicants' method includes forming a plasma, that plasma would naturally encompass similar properties, including an electron temperature of 0.5-2 eV.

36. As to claims 50 and 51, Ohmi I does not expressly disclose that the plasma has a plasma density of 1×10^{10} to $5 \times 10^{12}/\text{cm}^3$. However, Rossnagel teaches that a typical density for a plasma etch (or clean) is 10^9 to 10^{10} cm^{-3} (Table 1, page 198). It should be noted that Applicants' density range is similar to Rossnagel's density range. Therefore, because Applicants' method includes forming a plasma, that plasma would naturally encompass similar properties, including a density of 1×10^{10} to $5 \times 10^{12}/\text{cm}^3$.

Claim Rejections - 35 USC § 103

37. Claims 52 and 53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ohmi I, in view of Wolf I, in further view of Mintz, in further view of Ohmi et al. (U.S. Patent No. 6,357,385) ("Ohmi II").

Art Unit: 1765

38. As to claims 52 and 53, Ohmi I discloses that the plasma is generated by using a plane antenna member (106) (paragraph 0043). Ohmi I does not expressly disclose a plane antenna member having a plurality of slots. Ohmi II discloses a plane antenna member (201) with a plurality of slots (110) (column 19, lines 43-48; Figure 2). Ohmi II further discloses that the plurality of slots (110) result in the more uniform radiation of electromagnetic waves (column 19, lines 49-61) for the creation of a plasma (column 20, lines 7-11). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a plane antenna member having a plurality of slots. One who is skilled in the art would be motivated in creating a more uniform radiation of electromagnetic waves for the creation of a plasma.

Claim Rejections - 35 USC § 103

39. Claims 60-63 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ohmi, in view of Wolf I, in further view of Mintz, in further view of Wolf IV, in further view of Hallyal et al. (U.S. Patent No. 6,451,641).

40. As to claims 60-63, Ohmi does not expressly disclose that the High-k film is a silicate or aluminate, wherein the silicate is ZrSiO or HfSiO or the aluminate is ZrAlO. Hallyal discloses the hafnium silicate (or HfSiO) is a high-k material (column 3, lines 20-32) suited for a gate dielectric (column 2, lines 33-34). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use HfSiO as the high-k film. One who is skilled in the art would be motivated to find a high-

Art Unit: 1765

k material replacement for silicon oxide as a gate dielectric to reduce the undesirable tunneling effects, and to use a material known to be effective as a gate dielectric.

Response to Arguments

41. Applicant's argument that Ohmi does not disclose a rare gas for cleaning step is acknowledged. In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

Applicant's argument that the combination of references does not suggest conducting the first and second steps under the same operation principle is found unpersuasive because they are both done with a plasma. Therefore, both steps would satisfy claimed same operational principle. In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., conducting the cleaning step and oxidizing step to form an oxide film in the same vessel without exposure of the substrate to air) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Duy-Vu N. Deo whose telephone number is 571-272-1462. The examiner can normally be reached on Mon-Fri.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Duy-Vu N Deo
Primary Examiner
Art Unit 1765



12/21/06